Aviation Weather Testbed Overview

Dr. Steve Lack,

Techniques Development Meteorologist

AWC

17 April 2014: 5th NOAA Testbed & Proving Ground Workshop

Outline

- AWC Mission and Overview
- Testbed Objectives
  - NextGen Activities
  - Product Evaluation
  - GOES-R Training
  - AWIPS-II Migration
- AWT Experiments
  - Past and Future

AWC Vision

To be the trusted authority and leading innovator for aviation weather information.

AWC Mission

The AWC delivers consistent, timely and accurate weather information for the world airspace system. We are a team of highly skilled people dedicated to working with customers and partners to enhance safe and efficient flight

Aviation Weather Center Staff

Director: Bob Maxson

Deputy Director: Clinton Wallace

WCM: Pat Murphy

Executive Officer: Cmdr. Joe Bishop

Admin Officer: Pam Bouallegue

Admin. Assistant: Roy Tadeo

CIRA Admin. : Jenna Dalton

Domestic Chief: Deb Blondin

NAM (ATCSCC): MIC (***VACANT***), Mike Eckert, Brandon Smith, ***VACANT***

Lead Forecasters: Paul Fike, Jim Roets, ***VACANT***, ***VACANT***, ***VACANT***

FA Forecasters: Karen Eagle, Christa Jacobs, Larry Jacobs, Liam Lynam, Shari Mutchler, Dennis Nelson, Greg Poulos, Brad Regan, Pete Reynolds, Mike Streib

CCFP Forecasters: Bill Barlow, JoAnn Becker, Ingrid Greenwall, Greg Harris, Mike McCoy

Convective Sigmet Forecasters: Katie Deroche, Andy Fischer, Jeramie Lippman, ***VACANT***, ***VACANT***

International Chief: Matt Strahan

Global Forecasters: Doug Behne, Steve Burback, Hugh Crowther, Richard Douglass, Nolan Duke, Ted Hoffman, Ed Holicky, James Joynes, Marissa Sette, Jonathan Slemmer, Jesse Sparks, Adam Stout, Dan Zacharias

Summary:
52 Federal Employees
7 Vacancies
11 Contractors

Support Branch Chief: David Bright

SOO: Bruce Entwistle

TDM: Steve Lack, Ryan Solomon, ***VACANT***

R&D: Steve Silberberg, Amy Harless, Tim Mahoney

IT Specialists: Steve Chance, Larry Hinson

CIRA IT Specialists: Dan Vietor, Adrian Noland, Larry Greenwood, Mick Ohrberg, Chad Hill, Lee Powell

CIRA NextGen Met: Ben Schwedler

CIRA AWRP Met: Brian Pettegrew

CIMSS GOES-R Met: Amanda Terborg

Jamison Sys. Engineer: Jim McDuffie

AWC's Partners/ Stakeholders

- FAA
  - Command Center
  - Flight Service Stations
  - Research and Development (AWRP)
  - Policy and Requirements
- NWS
  - CWSUs
  - AAWU
  - WFOs
  - NCEP Centers
    - SPC, SWPC, TPC, HPC, NCO
- USAF
  - Weather Agency (AFWA)
  - 15 OWS, Scott AFB
- Airline Met Services
- United Kingdom's Meteorological Office
- Meteorological Service of Canada (MSC)

Domestic Operations Branch

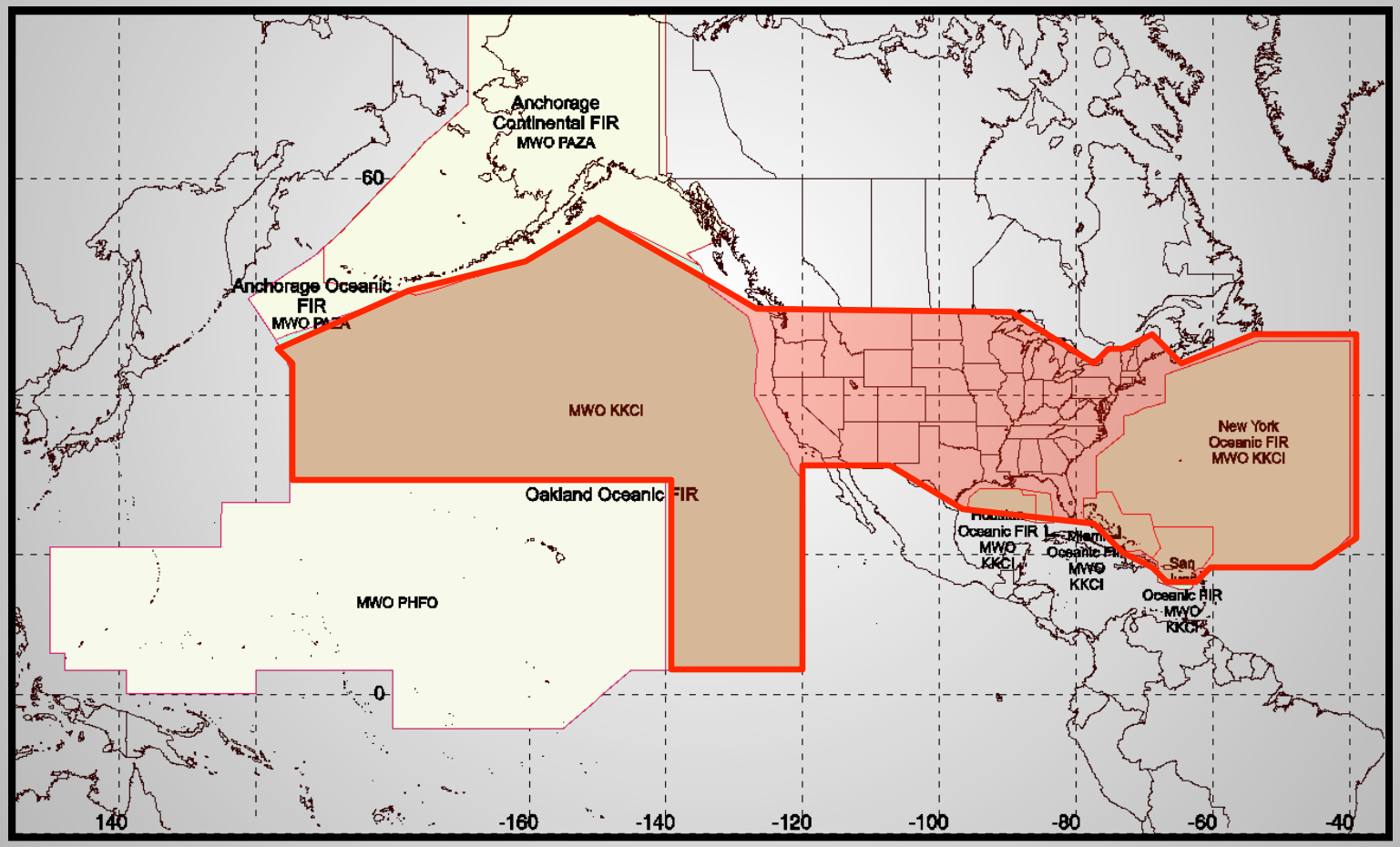
- **Five Operational Desks**
  - FA East, Central, West
  - CCFP (Collaborative Convective Forecast Product)
  - Convective SIGMET
- **Domestic Products**
  - SIGMETs – Aviation Warnings
  - AIRMETs – Aviation Advisories
  - FA – Aviation Area Forecast
  - CCFP – NAS Convective Planning Forecast
  - SIGWX Low – Significant Low-Level Aviation Graphic

International Operations Branch

- **Three Operational Desks**
  - SGWX Northern Hemisphere
  - SGWX Southern Hemisphere
  - Tropical Desk

- **International Products**
  - Significant Weather High
    - Global 24-hour High-Level Forecasts
  - Oceanic SIGMETs
    - Aviation Warnings for Atlantic and Pacific
  - FACA and FAGX
    - Area forecasts for the Caribbean and Gulf of Mexico

AWC's Area of Responsibility for Aviation Warnings (SIGMETs)



World Area Forecast Center

- World Area Forecast System (WAFS)
  - Formulated by ICAO and the WMO
  - Improve the quality and consistency of enroute guidance provided for international aircraft operations
- World Area Forecast Centers (WAFC)
  - WAFC – Washington
    - AWC provides Significant Weather Forecasts
    - NCEP Central Operations Provides Wind and Temperature Grids Charts
    - NWS Telecommunications Gateway supports satellite data broadcasts
  - WAFC – London
    - Met Office – Exeter

AWC Product Issuances

Product	#/Year
Convective SIGMET	30,000
Non-Convective SIGMET	500
Collaborative Convective Forecast Product (CCFP)	25,000
AIRMETs	26,280
Area Forecasts (FA)	6,570
Significant Weather Low	1,460
Significant Weather High	18,890

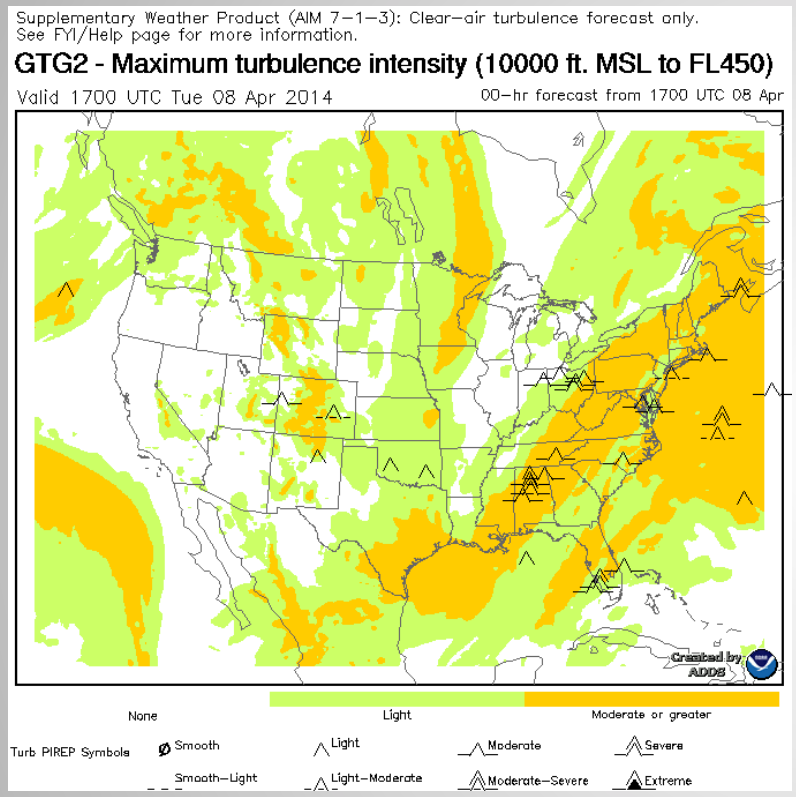
Aviation Weather Testbed Mission

- Focus on support and enhancement of AWC's mission and its customers and partners.
- Explore and develop science and technology innovations
- Assesses results relative to existing operations
- Accelerates transition of promising technologies into NWS operations
- Key player in developing aviation weather services for NextGen

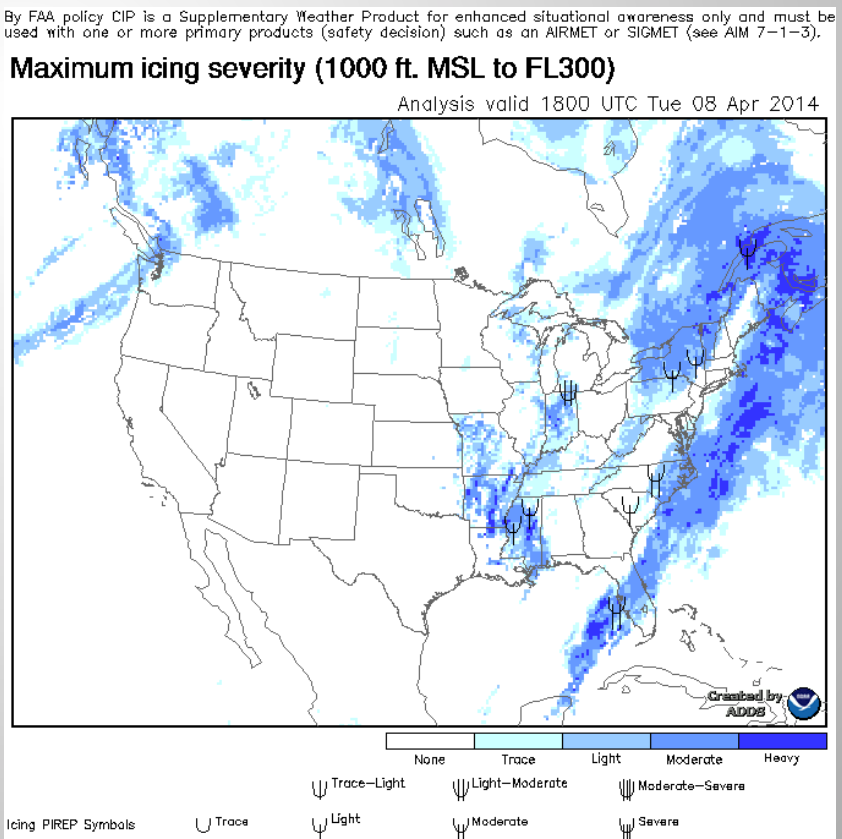
R ⟺ O

- Research to Operations:
  - Traditionally the focus of testbeds
  - A lot of aviation research going on across the board
    - NWS -> (MDL, ASB, NextGen, AWC, SPC)
    - NOAA OAR -> (GSD, NSSL)
    - FAA (AWRP, CDM WET)
    - NCAR/MIT LL
    - MITRE/AvMet
  - Many products are tested and transitioned in some way through the AWT
- Operations to Research:
  - Cannot be ignored
    - HITL/HOTL considerations
  - Is this product useful for the AWC forecaster?
    - Scope of the product (time and space)
    - Verification compared to other operational tools
    - Efficiency of job-related tasks
    - Training considerations

GTG and FIP



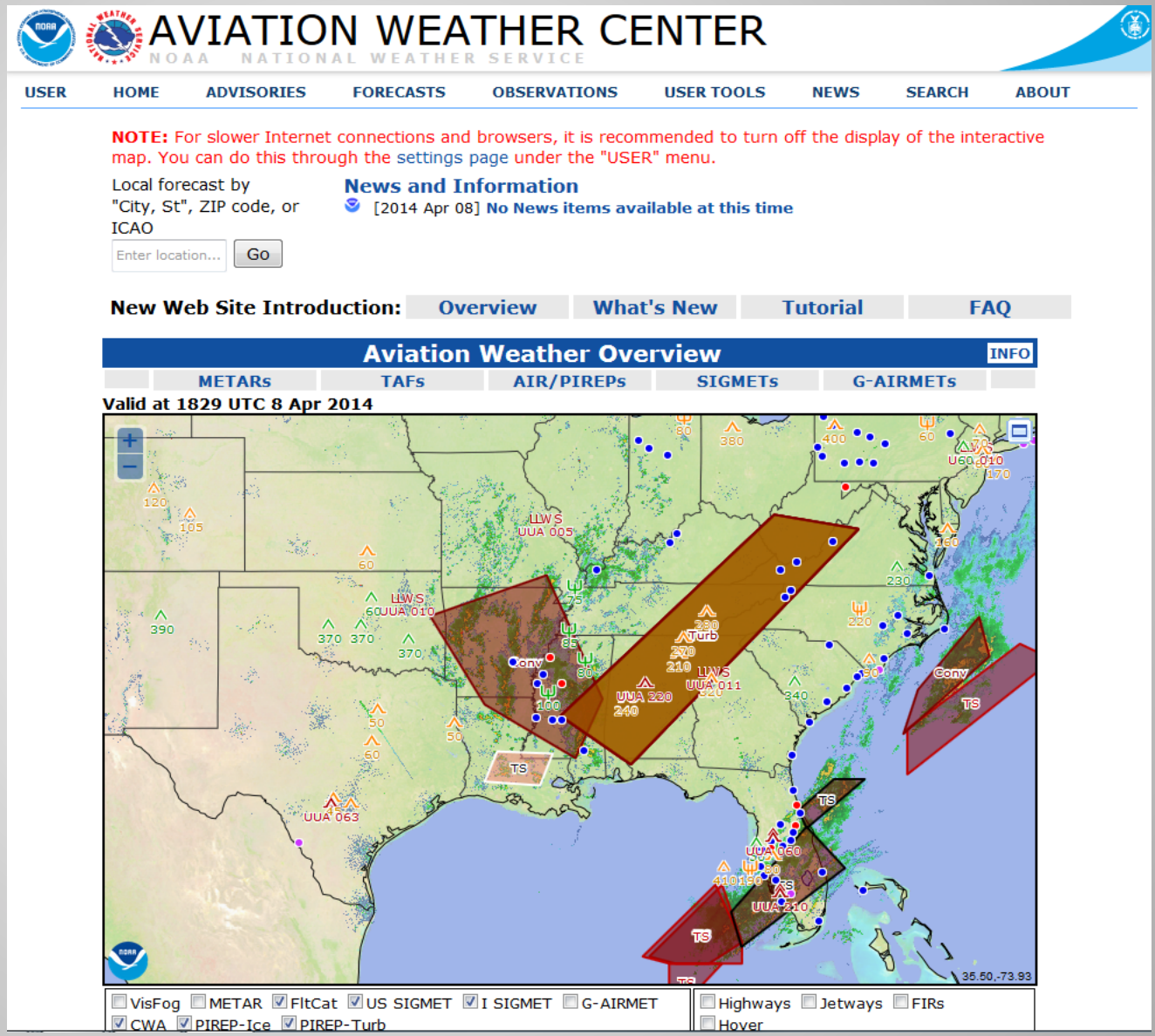
Current and Forecast Icing Product (CIP & FIP) and Graphical Turbulence Guidance (GTG) are operational through aviationweather.gov as a supplementary guidance product .



CIP, FIP and GTG are available for use by the forecasters through NMAP. Forecasters had little interaction with this product through the testbed during product development. Example of weak O -> R.

New Web Design

- Use of open layers for displaying features, SIGMET, AIRMET.
- Compatible with new NextGen data formats and requirements
- Compatible for tablets/mobile devices for easier use for the aviation community
- Retains classic views that will slowly be deprecated
- Tested and vetted through the AWT



NextGen at AWC

- NextGen effort has two primary parts
  - Content: New/Enhanced data and products
  - Information Technology: Dissemination methods

- Content
  - Fusion of weather and air-traffic information
  - New additions are largely probabilistic
  - Blending of forecast information from multiple sources

NextGen Data Dissemination

- Open Geospatial Consortium (OGC) Web Services
- Machine-to-machine data formats
  - Meta-data included for better product information
  - Searchable registries for users to locate data
- NextGen IT Web Services
  - NWS effort to provide NextGen data formats to the FAA
  - Allows subscriptions based on hazard, time, location, and other relevant parameters

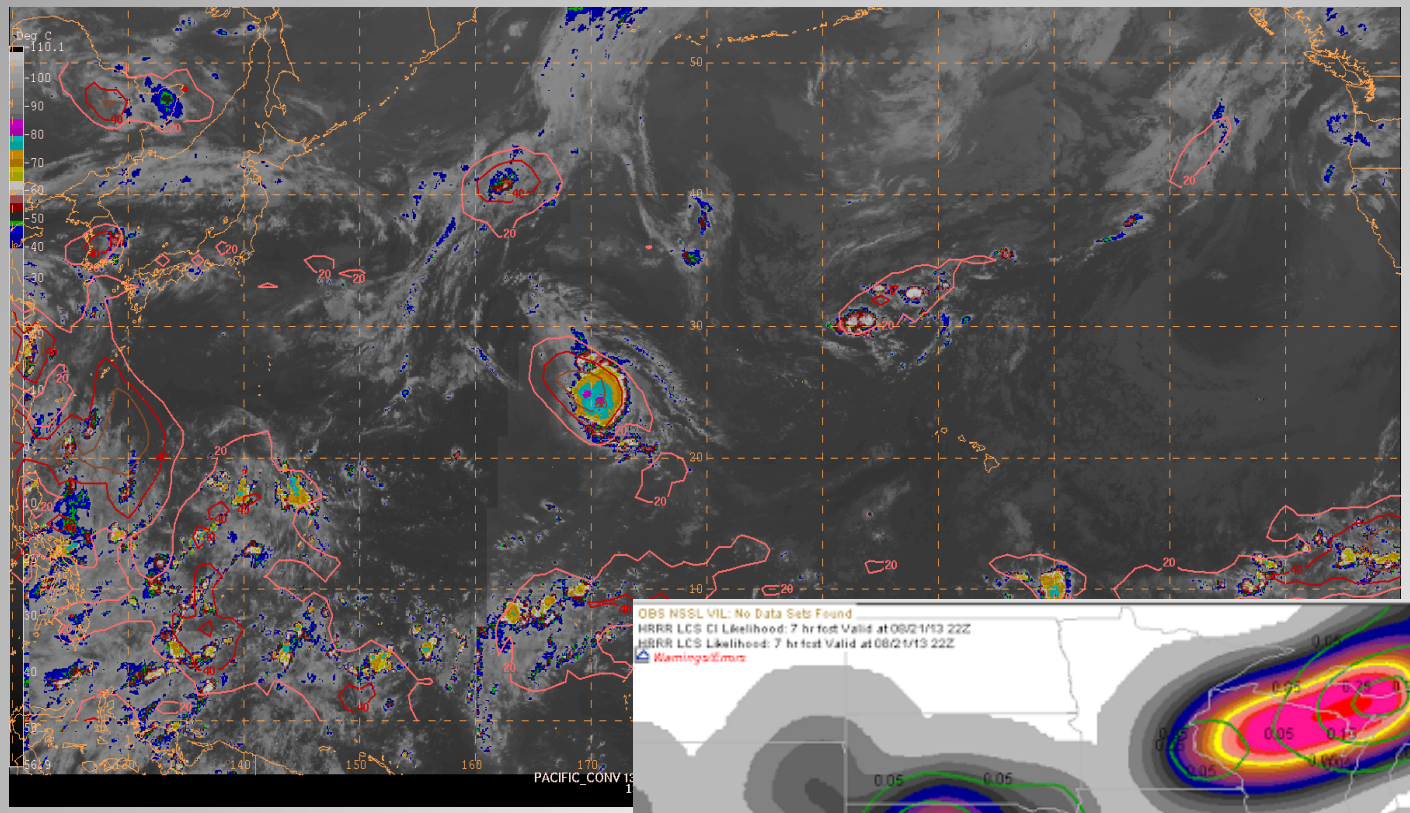
NextGen Data Formats

- Gridded data provided in NetCDF
  - Follows CF conventions for variable and meta-data
  - Meta-data included within the data file
- Non-Gridded data disseminated in XML
  - Weather Exchange Model (WXXM)
  - AWC is a contributing developer for the XML schema used to describe aviation forecast products

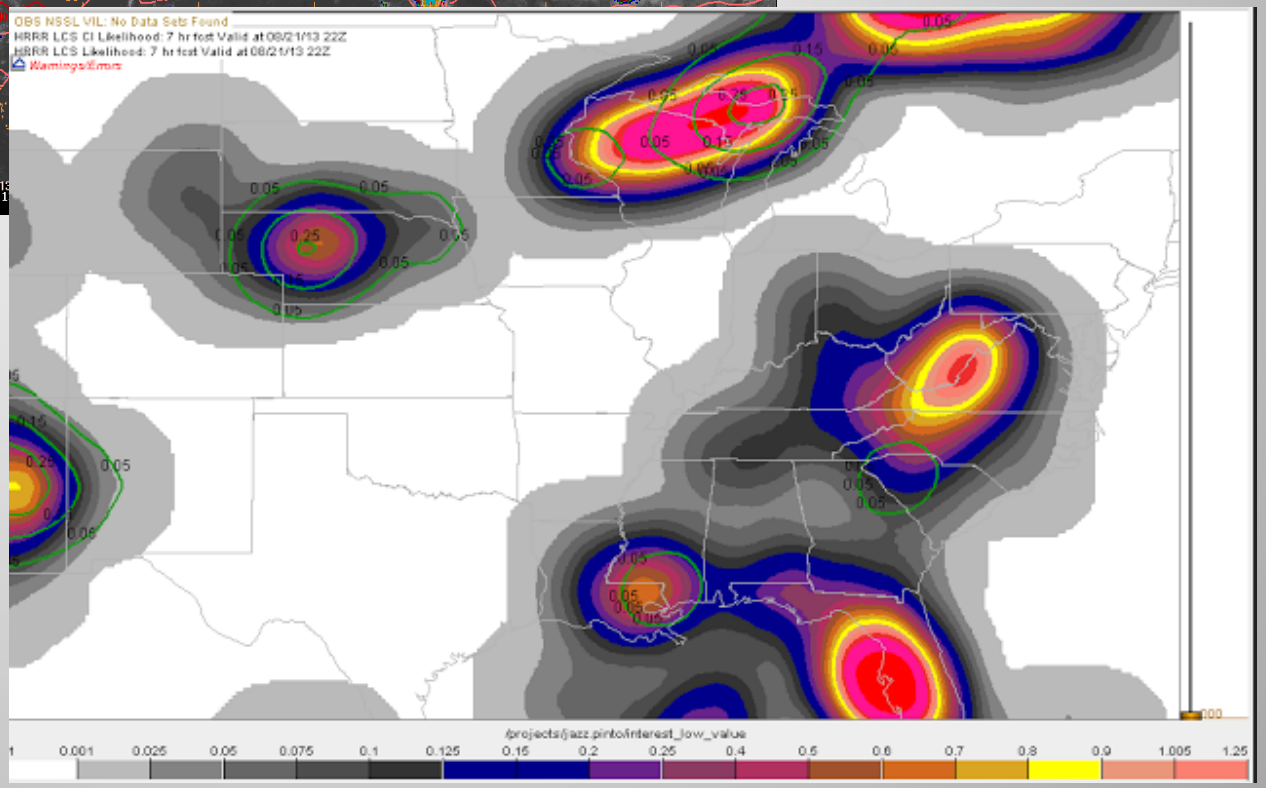
AWRP Product Testing

- Aviation Weather Research Program
  - FAA NextGen weather focus within FAA
- New convective product examples:
  - Large-scale Convective Probability
    - HRRR and AFWA versions for large-scale convection forecasting including convective initiation
  - Ensemble Prediction of Oceanic Convective Hazards (EPOCH)
- Turbulence product examples
  - GTG3 (unknown status for AWT activities)

*There is no support for AWRP products in official AWT activities, but this collaboration is necessary to support the AWC users. A formal FAA-NWS testbed relationship should be considered.



NCAR's EPOCH over
N Pacific used in 2013
AWT Summer Experiment



NCAR's Large Scale CI and
Convective Likelihood
fields used in the 2013
AWT Summer Experiment

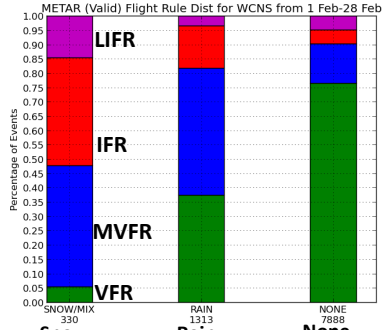
NOAA Product Testing

- Model upgrade evaluations
  - Ceiling and Visibility Improvements
    - SREF primarily
  - LAMP Evaluation
  - HIRES Window Evaluation
- New aviation forecast tools
  - HRRR Convective Probability Forecasts
  - NARRE Aviation Variables
  - NSSL WRF Aviation Variables
  - INSITE (NE US Convective Guidance based on Impact)

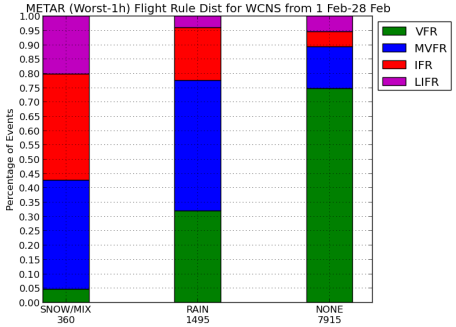
Flight Rules (Ceiling & Visibility) ImprovementsSREF Parallel vs. Operational – Flight Rule DistributionFebruary 1-28, 2014

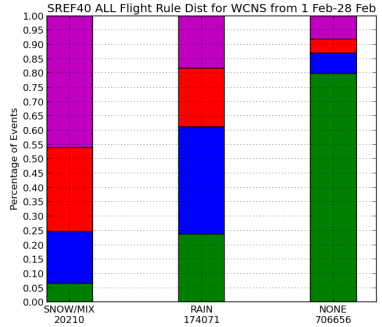
West Coast (Western OR/WA/CA)

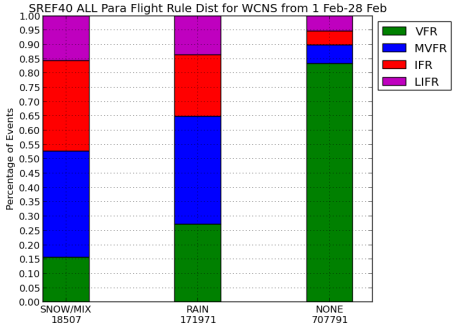
Hourly METARs



Special METARs





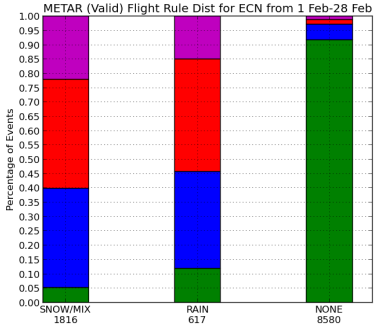


SREF

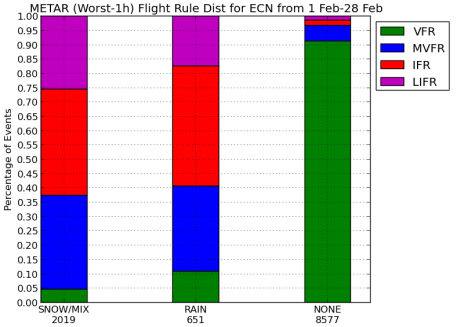
SREF-Parallel

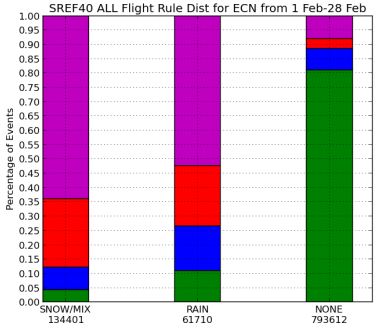
Northeast (NJ/Ern NY to Ern ME)

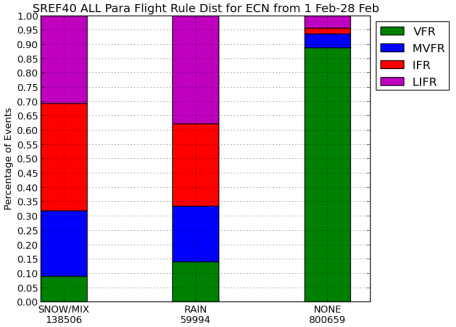
Hourly METARs



Special METARs



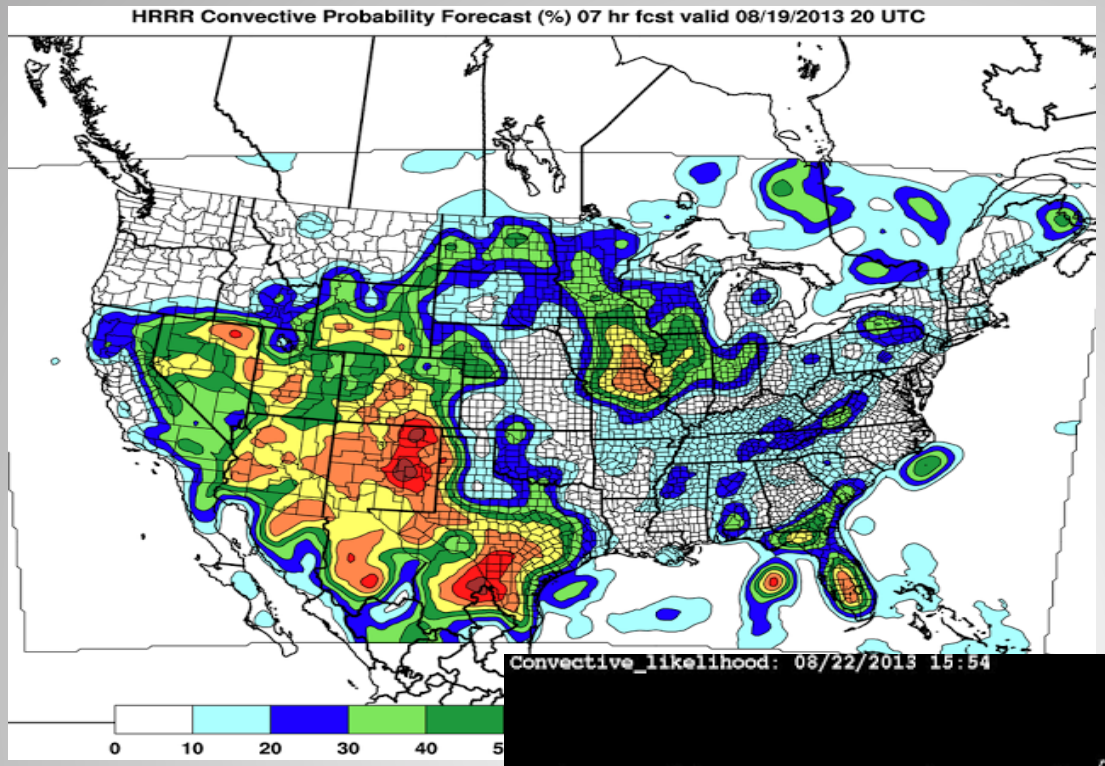




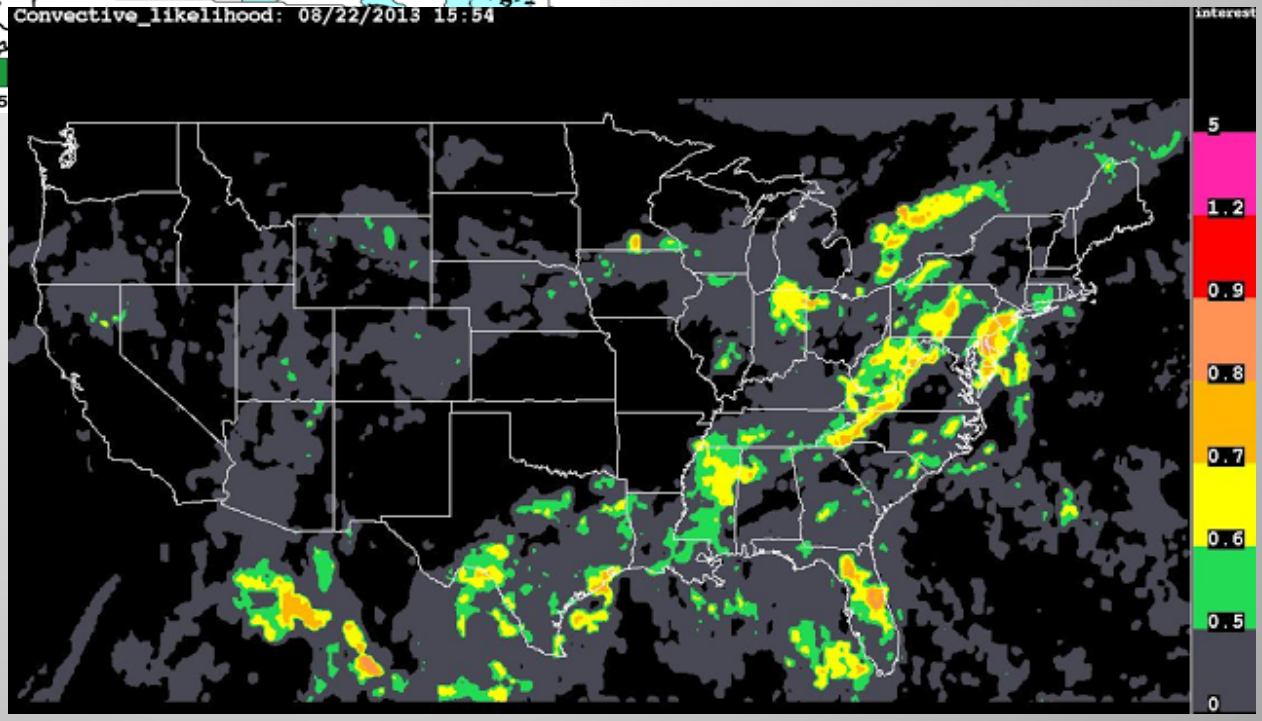
SREF

SREF-Parallel

- Overall, much improved distribution of C&V flight categories
  - Ceiling in particular very much improved (not shown)
  - Snow: High LIFR much improved; introduced a small, high VFR bias in snow
  - Rain: Generally improved all categories
  - None: LIFR improved NE and West; High VFR bias WC slightly increased



TL HRRR Convective Probability Forecast available during the 2013 AWT Summer Experiment

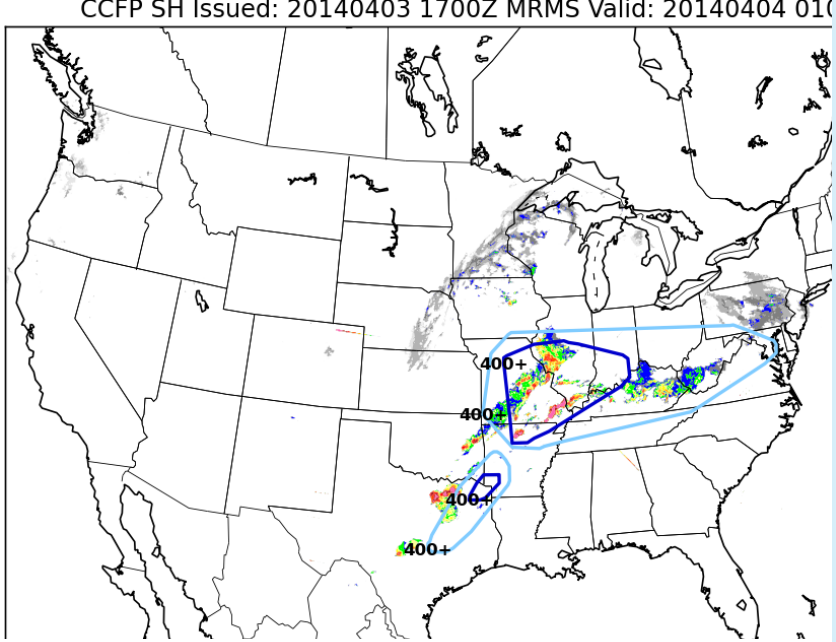


MDL's ANC convective likelihood field used for situational awareness available during the 2013 AWT Summer Experiment

See the INSITE Poster!

AWC Product Development

- Dashboards
  - Winter and Summer
- ECFP (Extended Convective Forecast Product)
- First Guess CCFP
- FA (Area Forecast) Guidance
- Timeliness Dashboard
  - Allows forecasters to address AWC issuance problems and efficiency
- Ensemble Processor
- Forecast Evolution
  - New National Aviation Meteorologist at FAA Command Center



AVIATION WEATHER CENTER RELEASE

NOAA NATIONAL WEATHER SERVICE

USER HOME ADVISORIES FORECASTS OBSERVATIONS USER TOOLS NEWS SEARCH ABOUT

Aviation Winter Weather Dashboard

INFO

<< Previous SREF Run
1500 UTC Sat 15 Mar 2014
Updated : 1914 UTC Sat 15 Mar 2014

Viewing Old SREF Run (View Latest)
2100 UTC Sat 15 Mar 2014
Updated : 0114 UTC Sun 16 Mar 2014
Current Time: 15:06:09 UTC Mon 17 Mar 2014

Next SREF Run >>
0300 UTC Sun 16 Mar 2014
Updated : 0734 UTC Sun 16 Mar 2014

Auto Update: ☐ ARTCC: ALL Region: Mid Atlantic Sort: Climate Impacts First: ☐ Hide Nominal: ☐ 24h Snow: ☑ Reset

	Sat 21Z	Sun 00Z	Sun 03Z	Sun 06Z	Sun 09Z	Sun 12Z	Sun 15Z	Sun 18Z	Sun 21Z	Mon 00Z	Mon 03Z	Mon 06Z	Mon 09Z	Mon 12Z	Mon 15Z	Mon 18Z	Mon 21Z	Tue 00Z	Tue 03Z	Tue 06Z	Tue 09Z	Tue 12Z	Tue 15Z	Tue 18Z	Tue 21Z	Wed 00Z	Wed 03Z	Wed 06Z	Wed 09Z	Wed 12Z
KIAD									S	S	S	SV	SV	SV	SV	SV	SV	S	S										
KBWI									S	S	S	SV	SV	SV	SV	SV	SV	S	S										
KDCA									S	S	S	SV	SV	SV	SV	SV	S	S	S										
KCLT																													
KROA								S	S						V	SV	S	S	S	S									
KAVL																		V											
KTRI																													
KCHO								S	S	S	S	SV	SV	SV	SV	SV	S	S	S										
KRIC									S				V				S	S	S										
KTYS																													
KGSO												F	F	F															
KPHF																		S	S										
KORF																													
KRDU													F	F															
KFAY																													
KGSP																													
KMYR																													
KILM																													
KCAE																													
KCHS																													

Aviation Summer Weather Dashboard (Experimental)

Product Description Document Product Survey

Current Time: 15:42:35 UTC Mon 22 Apr 2013

<< Previous SREF Run
0900 UTC Fri 19 Apr 2013
Updated : 1413 UTC Fri 19 Apr 2013

Viewing Old SREF Run (View Latest)
1500 UTC Fri 19 Apr 2013
Updated : 2015 UTC Fri 19 Apr 2013

21
Updated : 022

You are viewing a previous SREF run. When the dashboard automatically updates, the most recent SREF run will be shown.

	Fri 15Z	Fri 16Z	Fri 17Z	Fri 18Z	Fri 19Z	Fri 20Z	Fri 21Z	Fri 22Z	Fri 23Z	Sat 00Z	Sat 01Z	Sat 02Z	Sat 03Z	Sat 04Z	Sat 05Z	Sat 06Z	Sat 09Z	Sat 12Z	Sat 15Z	Sat 18Z	Sat 21Z	Sun 00Z	Sun 03Z	Sun 06Z
KBOS																								
KBWI	280						380	380	380	290	240													
KDCA		320	330		370	370	390	390	310	220														
BILIT1	290		350			390	390	390	380	320	270													
FRDMM1						360	380	320	260	150														
IRONS4		330	340		390	390	400	400	340	270	270													
NUMMY1		320	330		370	370	390	390	310	220														
OJAAY1	340	350	350		410	410	410	410	390	300	270													
SKILS2	280				370	380	380	380	290	240														
TRUPS1						360	380	320	260	150														
KEWR												190												
KIAD						370	370	250																
KJFK												280												
KLGA											300	260	170											
KPHL									350	290	200													
ARTCC IMPACTS																								
ZDC	420	430	440	430	430	420	410	420	410	400	400	400	390	350	320									
ZNY			320	350	360	370	380	360	350	340	310	250	240											
ZBW							310	310	300	300	290	290	260	240	230									
ZOB	290	290	320	350	350	300	220	150																

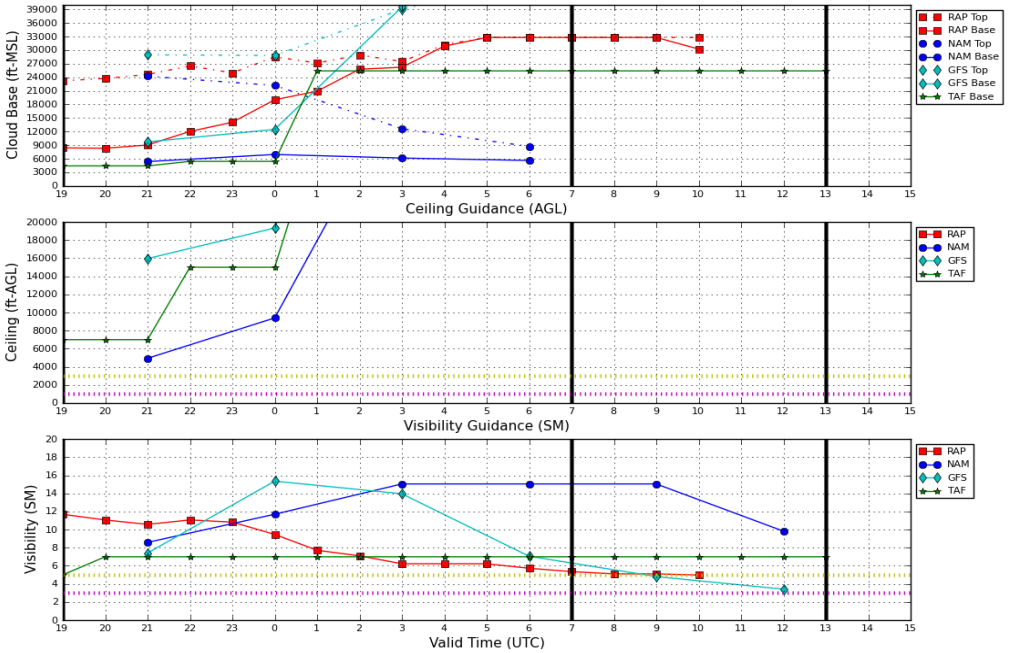
Impact Category: Nominal Slight Moderate High

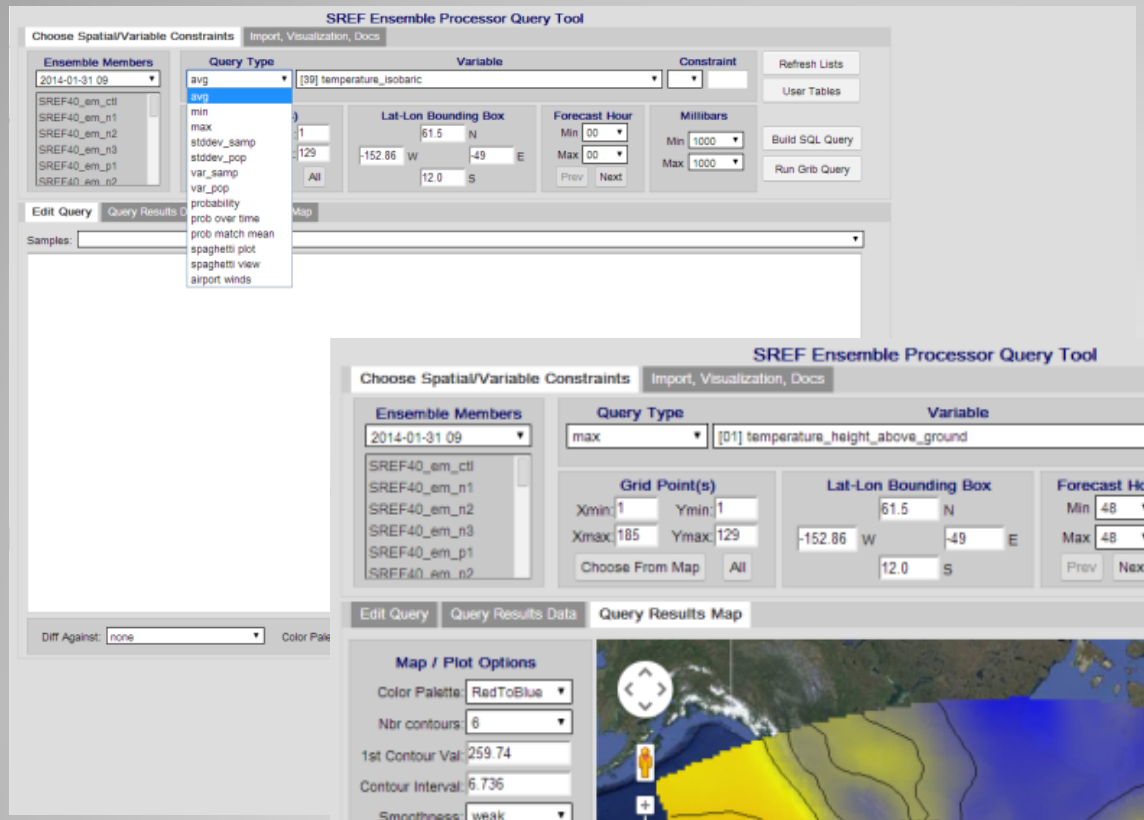
The Aviation Summer Weather Dashboard is an experimental product hosted at the Aviation Weather Testbed, located at the NOAA Aviation W
Its purpose is to provide a decision support tool to alert operational meteorologists and air traffic managers to potential summer weather impacts

View Archived SREF Run: 1500 UTC Fri 19 Apr 2013

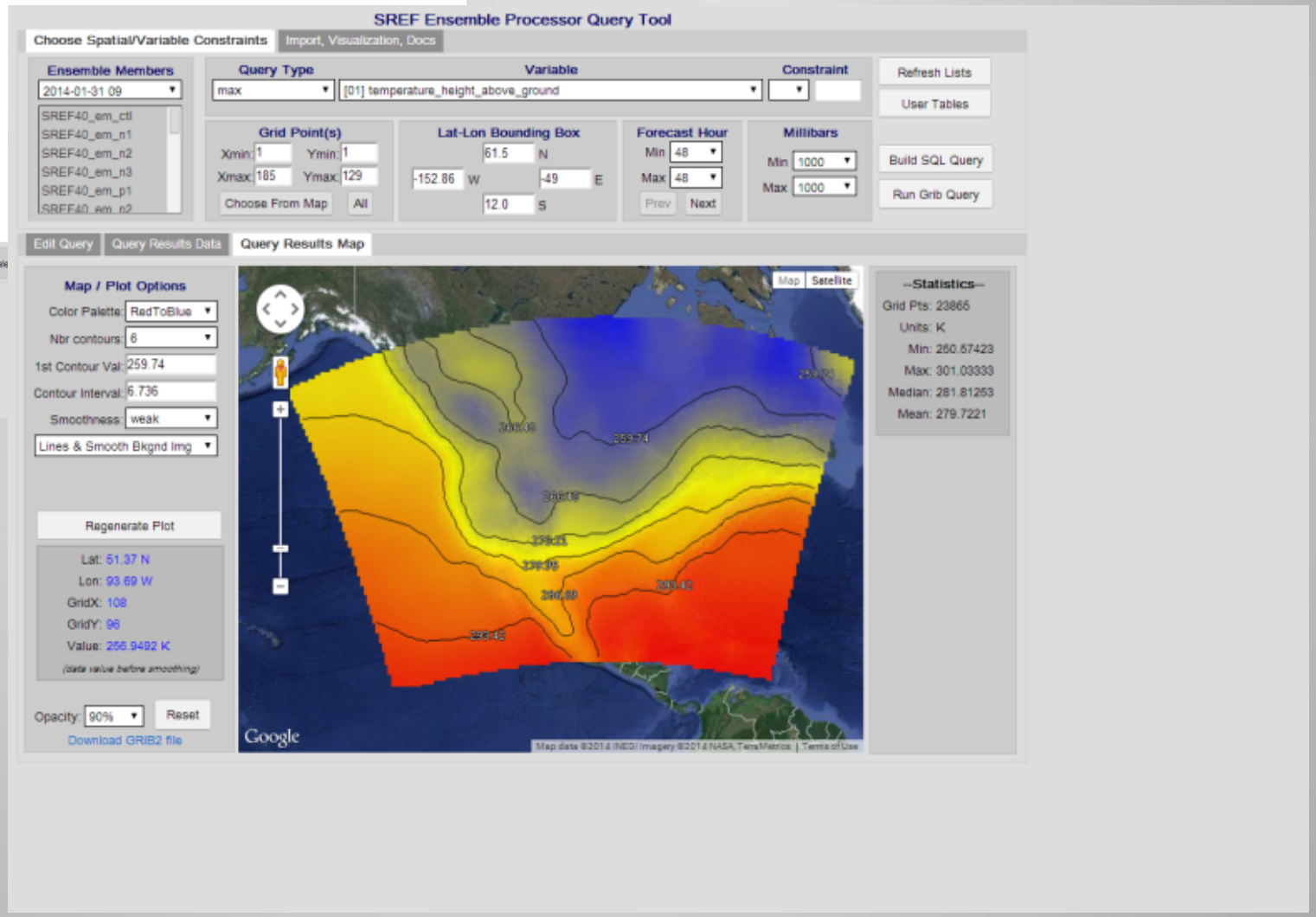
HPC Winter Weather Products | National Heavy Snow Discussion | HPC Probabilistic Winter Precipitation Guidance | SPC Short-Range Ensemble Products | SPC Short-Range Ensemble Plume Charts | A

FA issuance: 2014-04-08 19:00:00Z
Western KY----Elevation (ft): 410 (KPAH)
NAM issue: 2014-04-08 12:00:00Z RAP issue: 2014-04-08 16:00:00Z GFS issue: 2014-04-08 12:00:00Z
Cloud Top and Base (MSL) Guidance





Ensemble Processor: Joint work with CIRA, Customizable functions, output to GRIB2, NAWIPS formats, etc.



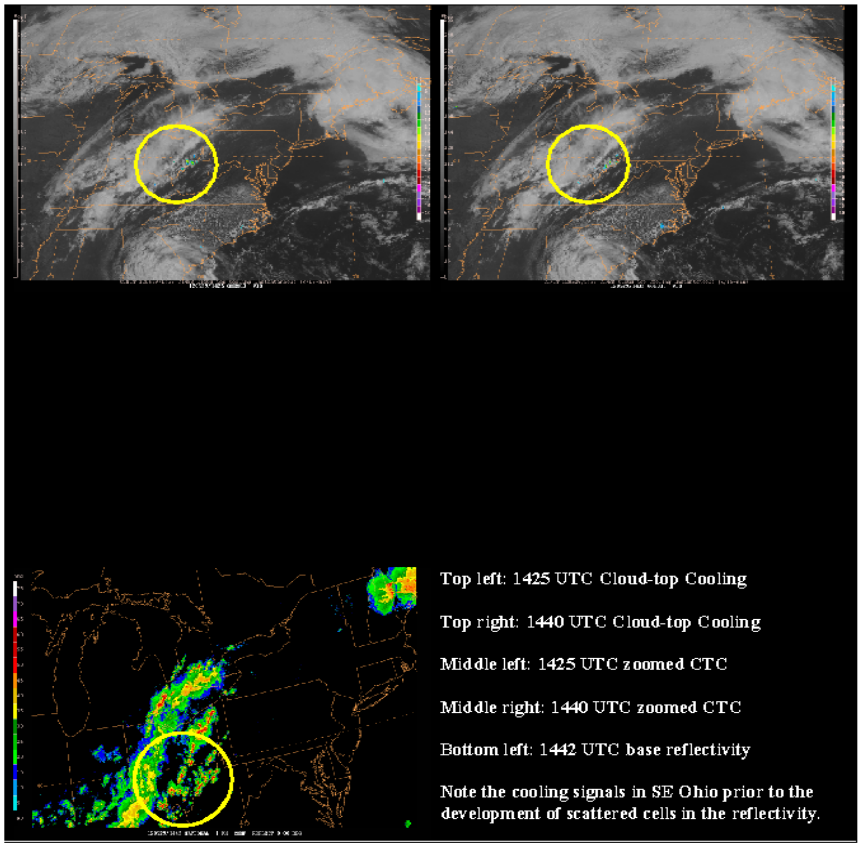
2014 GOES-R Evaluations

<table>
<tr><td colspan="3">2014 Demonstrations for the Aviation Weather Center – CIMSS products</td></tr>
<tr><td>Evaluation Period I</td><td>1 March – 19 May</td><td rowspan="2">Longer term demonstration periods, by-in-large one on one with forecasters
Products vary by desk (i.e. C&V, icing, and turb tools at the FA desk, CI and lightning tools at CSIG and CCFP, etc.)
Feedback collected via verbal discussion</td></tr>
<tr><td>Evaluation Period II (including a trip to the ATCSCC in DC)</td><td>19 May – 19 September</td></tr>
<tr><td>Summer Experiment (C&V and convection focused)</td><td>11 – 15 August</td><td>A one week, dedicated demonstration period in the AWT including both internal and external participants
Feedback collected verbally and via surveys</td></tr>
</table>

Table 1. CTC rates vs. NEXRAD radar parameters (Sieglaff et al. 2012)

	Weak CTC > -10 K	Moderate -10 K >= CTC >-20 K	Strong CTC <= -20 K
Composite Reflectivity	45 dBZ	50 dBZ	55 dbZ
18 dBZ Echo Top Height	40 kft	46 kft	50 kft
30 dBZ Echo Top Height	35 kft	39 kft	45 kft

	Lead time given a strong CTC rate (<= -20 K)
Composite Reflectivity	~15 min; 55 dBZ ~25 min; 60 dBZ 60+ min; 65+ dBZ
18 dBZ Echo Top Height	~5-8 min; to 40 kft ~20 min; 50+ kft
30 dBZ Echo Top Height	~10 min; 20-30 kft ~30 min; 50 kft

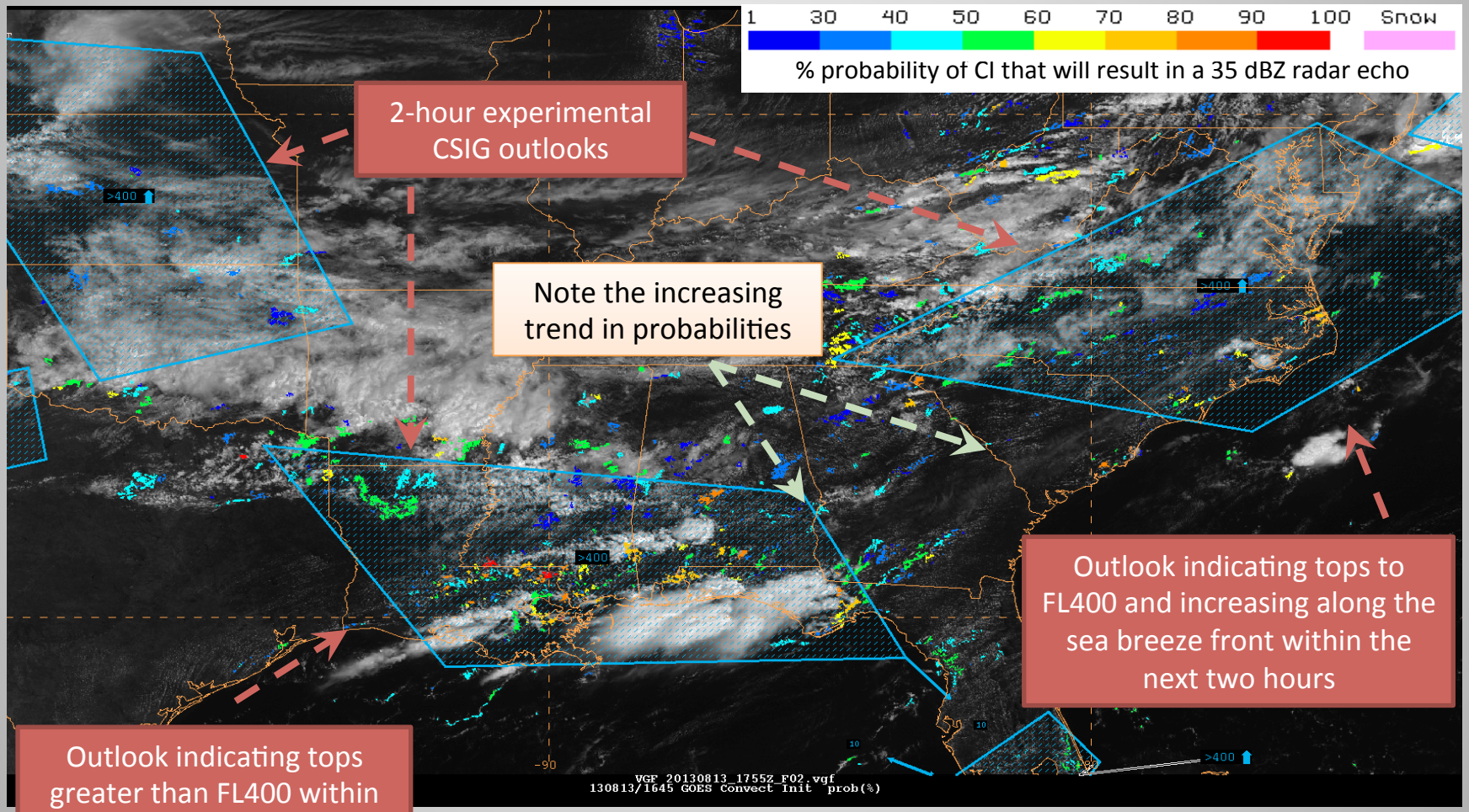


Last up dated: 4 April 2014

GOES-R Training

- Seminars… three ~30 minute, formal training seminars to introduce a new product
- Quick guides… short, one page overviews of each product; a brief summary, advantages and disadvantages, ways to use the tool in operations, links to additional material, and an example (sample on the left)
- 2-minute case studies… short, ~5-8 slide cases of a product being used for aviation forecasting operations. Sample on the next slide…

2-minute Case Study sample: August 13th, 2013… 1645 – 1945 UTC Convective Initiation and 1755 and 1855 UTC 2-hour CSIG outlooks



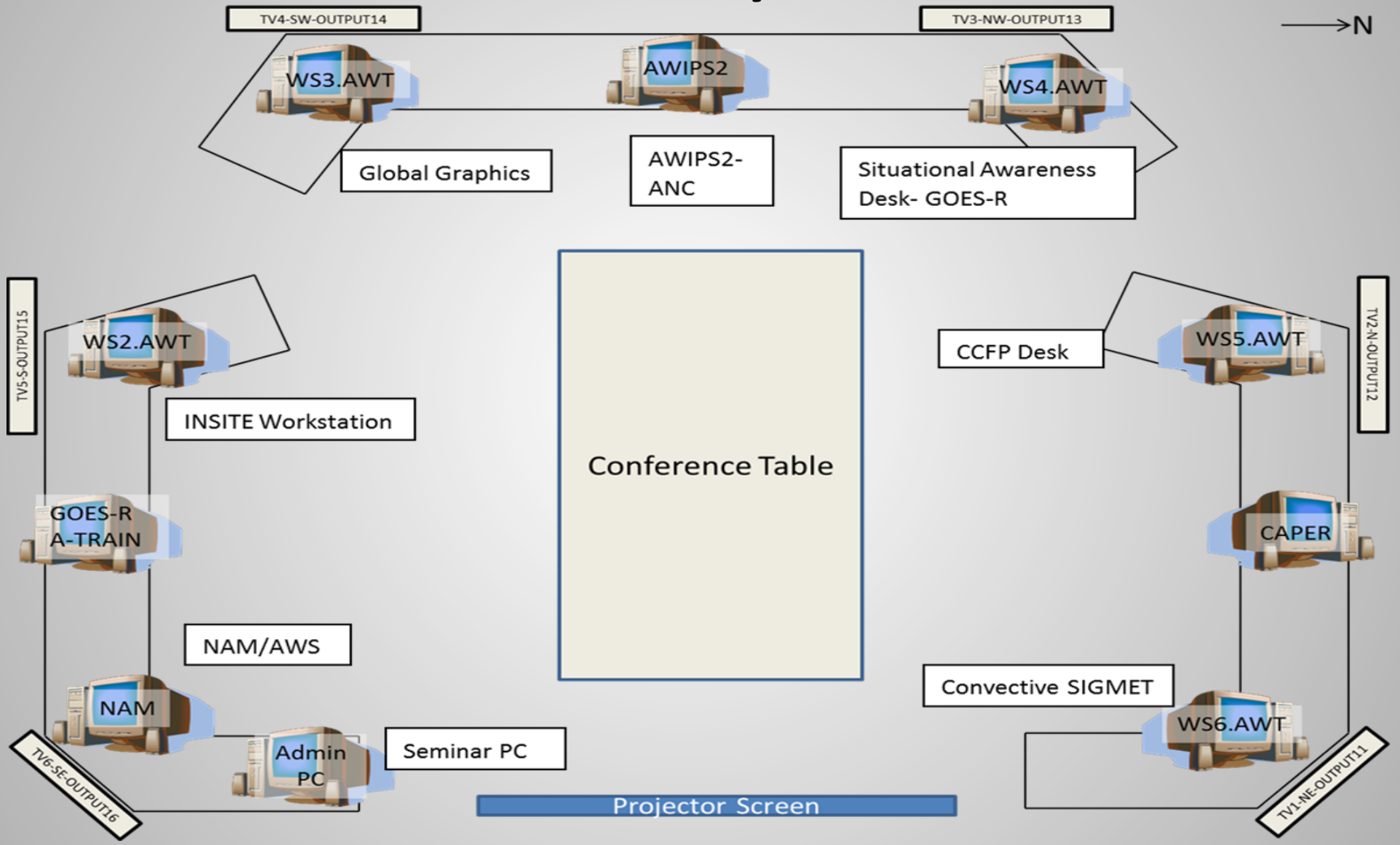
AWIPS-II and GOES-R

- Step 1: AWC operational satellite imagery
  - Ingestion
    - GOES-E and GOES-W data currently being pulled in via dbnet
    - Mosaic imagery to follow shortly
  - Configuration and display
- Step 2: GOES-R experimental imagery from the AWT
  - Non-SBN data flow
  - Configuration and display
- Step 3: GOES-R operational imagery (post-launch)
  - SBN and non-SBN data flow using the expected netcdf4 format
  - Configuration and display

AWIPS-II Testing

- AWIPS-II team has been developed at AWC
  - Forecasters, IT Specialists, SOO
- Begin testing of AWIPS-II capability to issue the domestic Convective SIGMET
  - Currently done in NMAP toolsets
- Begin to migrate other operational desks to AWIPS-II testing
- Eventually simulate full forecast operations in the testbed with full forecaster training
  - 8 operational desks will run live parallel tests using AWIPS-II instead of NMAP

AWT Layout



Example of the AWT Layout for the 2013 Summer Experiment, one more AWT workstation will need to be added for full simulation of the operational environment

AWT Experiment History

- Inaugural Summer Experiment 2011
  - Convective product focus:
    - CoSPA, Ensemble forecasts
    - GOES-R Products
- 2nd Summer Experiment 2012
  - Aviation Weather Statement development for the NE US
  - Convective model performance
- 1st Winter Experiment 2013
  - Experimental Icing and Turbulence Guidance
    - Global and International Focus, Ensemble vs Deterministic
- 3rd Summer Experiment 2013
  - Convective desk evolution, what can we provide differently
  - NAM desk, N Hemisphere Convection, GOES-R and new lightning datasets

Aviation Weather Services Branch

CWSU ZKC

NextGen

MDL

2013 Summer Experiment Participants


DELL
DELL


EMERGENCY
POWER
SHUT OFF

2014 Summer Experiment

- One week 11-15 August 2014:
  - Staff shortage
  - Will have internal mini-experiments throughout summer as time and forecaster availability permits
- 2 main goals:
  - Ceiling and Visibility Improvement
    - Evaluate high resolution forecasts and ensemble forecasts for best practices and best displays
    - Experiment with longer lead time forecasts
    - GOES-R ceiling and visibility products
  - Scope an Operational CONUS Aviation Weather Statement (convection)
    - Work with the CDM WET to jointly develop an official AWS ConUse/ConOps
    - Experiment with the real-time issuance of this event-drive product as a supplement to CCFP

Upgrades to AWT

- Additional workstations, some computing upgrades to support AWIPS-II migration
- Allow for ‘friendlier’ remote participation in testbed activities
  - Set up webex clients on all workstations, allow for sharing seminars and experiment post mortems on any testbed computer
  - Each workstation will have mic/speakers for audio
  - All sessions will be recorded via webex for archival purposes
    - Q&A better recorded

Questions/Comments

Testbed and Support Branch Questions:
david.bright@noaa.gov
AWT Experiment Questions:
steven.a.lack@noaa.gov